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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE



Applicant: Kondo, et al.
Serial No.: No. 09/982,770
Filed: October 22, 2001
For: SIZING AGENT AND RECORDING PAPER
COMPRISING SIZING AGENT
Art Unit: 1711
Examiner: UMAKANT K. RAJGURU

DECLARATION UNDER 37 CFR § 1.132

Honorable Commissioner of
Patents and Trademarks
Washington, D.C. 20231

Sir:

I, Yoshiyuki Kondo, a citizen of Japan, declare that:

- (1) I am one of the inventors listed in the above-identified application.
- (2) I reside at 526-3 Kuiseke4, Koushoku-shi, Nagano-ken, Japan.
- (3) I graduated from Chiba University, Faculty of Education in 1962, specializing in Science, and also studied in Graduate School of Engineering, Nihon University, from April 1962 to March 1964, specializing in Applied Chemistry, being granted a degree of the Doctor of Engineering by Nihon University in December 1970.
- (4) I joined Shinshu University in 1964, as an assistant in Faculty of Textile Science and Technology, and was an assistant professor from January, 1975 (Highpolymer Properties) to September 1986 (Bio Science and Textile Technology in Graduate School of Science and Technology, specializing in Biopolymer since June 1982), studying in Brain Laboratory of the Medical Department, Rochester University, New York in the U.S.A., from September 1981 to June 1982, as a research fellow abroad of the Ministry of Education, Japan.

(5) I was Professor of Biopolymer, Faculty of Textile Science and Technology, Shinshu University, since October 1986, and held an additional post of Professor of Biopolymer Engineering in the Department of Biological Function Engineering, Graduate School of Science and Technology, Shinshu University, since April 1991.

(6) I am now Professor of Organ Highpolymer Engineering in the course of Medical Science, specializing in Organ Transplants and Cellar Engineering, Graduate School of Medicine, Shinshu University since April 2000.

(7) I am familiar with the present invention and the prosecution history of the above-identified application.

(8) I have reviewed the Office Action mailed October 24, 2003 and the reference cited by the Examiner.

(9) To demonstrate difference between the water-soluble soybean polysaccharide of the present invention and the commercially available water-soluble polysaccharide disclosed in the cited reference, Auhorn et al. (US Patent 4,908,204) (Auhorn) in fixing and color development of ink on a paper surface and to show an advantage of the present invention over Auhorn, I have conducted the following experiments.

Experiments

(1) Preparation of Sizing Agents

Three sizing agents in RUN Nos. 1-3 having a composition shown in Table 1 below were prepared.

1. Starting material

(1) Water-soluble polysaccharide

RUN No. 1:

Water-soluble soybean polysaccharide; Tradename "Soyafive S-DN," available from Fuji Oil Co., Ltd.

RUN No. 2:

Carboxymethylcellulose-sodium, available from Daicel Chemical Industries, Ltd.

RUN No. 3:

Methylcellulose (water-soluble cellulose-ether); Trade name "SM-15," available from Shin-Etsu Polymer Co., Ltd.

Table 1
Composition of Sizing Agent (parts by weight on a solid basis)

| RUN No. | 1(7) ^{*1)} | 2 ^{*2)} | 3 ^{*2)} |
|--|---------------------|--------------------|--------------------|
| Water-Soluble (Soybean) Polysaccharide | 1.2 ⁽¹⁾ | 1.2 ⁽²⁾ | 1.2 ⁽³⁾ |
| Cationic Polymer | 1.2 | 1.2 | 1.2 |
| Alumina | 0.6 | 0.6 | 0.6 |
| Surfactant | 0.6 | 0.3 | 0.3 |
| Water | 96.7 | 96.7 | 96.7 |

Note:

- (*1) EXAMPLE, which corresponds to EXAMPLE No. 7 in Table 1 of the specification.
(*2) COMPARATIVE EXAMPLE disclosed in the cited reference US Patent 4,908,204 to Auhorn et al., Column 7, lines 26-29.

(2) Cationic polymer

Viscous cationic polymer obtained by polymerizing a mixture of 70 parts by weight of N,N-dimethylaminoethyl acrylate-methyl chloride and 30 parts by weight of dimethyl acrylamide in a 15% concentration.

(3) Alumina

Easily sinterable, low-sodium alumina (Tradename "AES-12," available from Sumitomo Chemical Co., Ltd.).

(4) Surfactant

Nonyl phenol ("Brownon N-509," HLB of 12.8 available from Aoki Oil Industrial Co., Ltd.).

2. Preparation of sizing Agents

RUN No. 1:

This composition was the same composition with that described in EXAMPLE No. 7 in Table 1 of the specification of the present application,

obtaining a sizing agent without any precipitate.

RUN No. 2:

Polymer of N,N-dimethylaminoethyl acrylate-methyl chloride was diluted by pure water, and to the resultant aqueous solution was added slowly 2% aqueous solution of CMC-Na with stirring by a magnetic stirrer, thereby resulting in the formation of precipitates. Accordingly, the sizing agent comprising CMC-Na could not be prepared.

Thus, several experiments under the different conditions such as (1) heating, (2) increasing of pH (by adding 5% aqueous solution of NaOH) and (3) changing an aqueous solution of cationic polymer to an alkaline solution thereof were carried out, thereby resulting also in the formation of precipitates, so that sizing agents could not be prepared.

The precipitation mentioned above is presumably due to the formation of coagula between polymer of N,N-dimethylaminoethyl acrylate-methyl chloride (cationic polymer) and CMC, considering the formation of precipitates in the case of adding CMC (anionic polymer) under an alkaline condition. It is noted that the precipitation did not occur merely due to the pH change of an aqueous solution of CMC-Na to an acidic side.

RUN No. 3:

When methylcellulose was mixed with cationic polymer, there occurred no precipitate, so that a sizing agent could be prepared.

3. Preparation of test samples.

A raw paper having a basis weight of 70 g/m² was coated with a sizing agent having a composition shown in RUN No. 1 and RUN No.3 above, respectively, by a bar coater in an amount of 5 g/m² on a solid basis, and dried at 120°C for 5 minutes in an oven.

Each recording paper thus obtained in RUN No. 1 and RUN No. 3 was used for full-color printing with an inkjet printer (color bubble-jet printer "S600," available from Canon Inc.).

4. Measurements

Printed samples were evaluated with respect to color development,

water resistance.

- (1) Color Development: Spectrophotometer ("NF-333" available from Nippon Denshoku Industries Co., Ltd.).
- (2) Water Resistance: Evaluated by measuring by the naked eye the blur of image on a sample that was fixed at an angle of 45° immediately after printing, on which 750 µl of water was dropped.

The evaluation standards of the water resistance were as follows:

- ◎: Completely no blur.
- : Slight elution of ink into water, with no blur of ink on the paper.
- △: Slight blur of ink on both surfaces of the paper.
- X: Extreme blur of ink on both surfaces of the paper.

Besides the color development and water resistance above, the feathering, bleeding test and ink fixation were evaluated as follows.

- (3) Feathering: Measured by the naked eye the blur of image of the portion of the fine lines of each printed chart.
- (4) Bleeding test: Evaluated by measuring by the naked eye the blur of image between Red and Black, and Yellow and Black, respectively.
- (5) Ink fixation: Evaluated by slipping the fully black printed portion with a loading of 40 g/m².

5. Results and Discussion

The results are shown in Table 2 below with printed-papers (A) and (B) attached hereto.

Table 2 Results of Evaluation

| No. | Color Development of Ink | | | | Water Resistance |
|-----------------------------|--------------------------|--------|-------|-------|------------------|
| | Red | Yellow | Blue | Black | |
| EXAMPLE (A) (RUN No. 1) | 1.127 | 0.825 | 1.153 | 1.254 | ◎ |
| COM. EX. (B) (RUN No. 3) | 1.055 | 0.798 | 1.111 | 1.262 | X |

As is clear from Table 2 above, in EXAMPLE using the sizing agent of the present invention, excellent color development was achieved in red, yellow and blue colors except for black color. However, it is noted that the difference of the measured values between EXAMPLE and COMPARATIVE EXAMPLE in hundredth is within measurement errors.

Also, in EXAMPLE coated by the sizing agent of the present invention, the water resistance was improved greatly from that in COMPARATIVE EXAMPLE coated by the available sizing agent. The significantly advantageous feature of the sizing agent using the water-soluble soybean polysaccharide of the present invention over that of the sizing agent using the commercially available water-soluble polysaccharide in the water resistance can be found by comparing the backside surfaces of both printed-papers (A) and (B). In the backside surface of the printed-paper (A), no blur of ink is observed.

With respect to the feathering, bleeding test and ink fixation, the printed-paper (A) seems be not always superior at glance to the printed-paper (B) in all of these three aspects. One reason of these phenomena is presumably due to the raw paper having no uniformly planed surface, which has been prepared in a laboratory scale without using necessary additives and machines to be used for mass production.

6. Conclusion

As mentioned above, the sizing agent of the present invention is superior to that made of the commercially available water-soluble polysaccharide in ink concentration, color development and water resistance in recording papers.

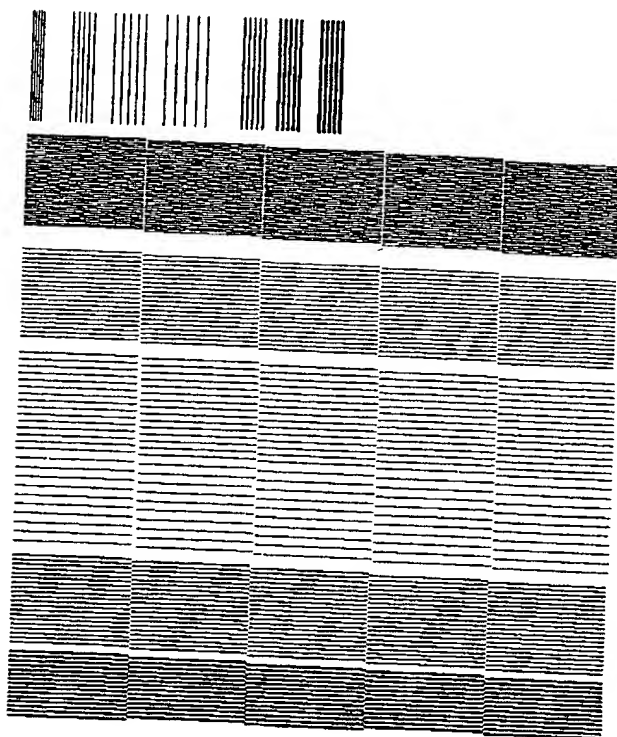
Therefore, it is clear that the claimed invention recited in claim 17 of the present application is not obvious over Auhorn.

(10) I declare further that all statements made herein on personal knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Dated February 19, 2004

Yoshiyuki KONDO

Yoshiyuki KONDO

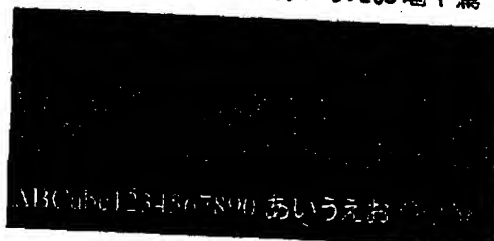


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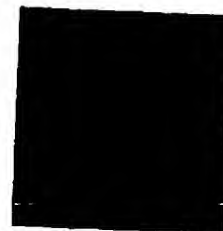
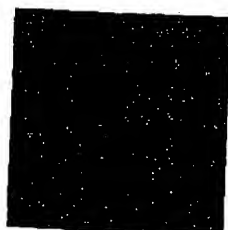
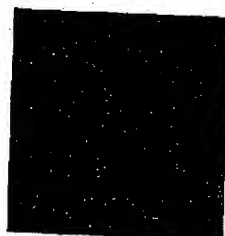
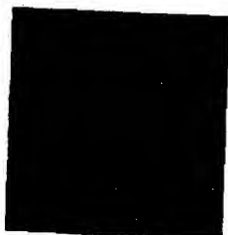
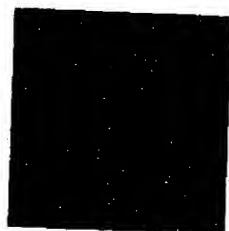
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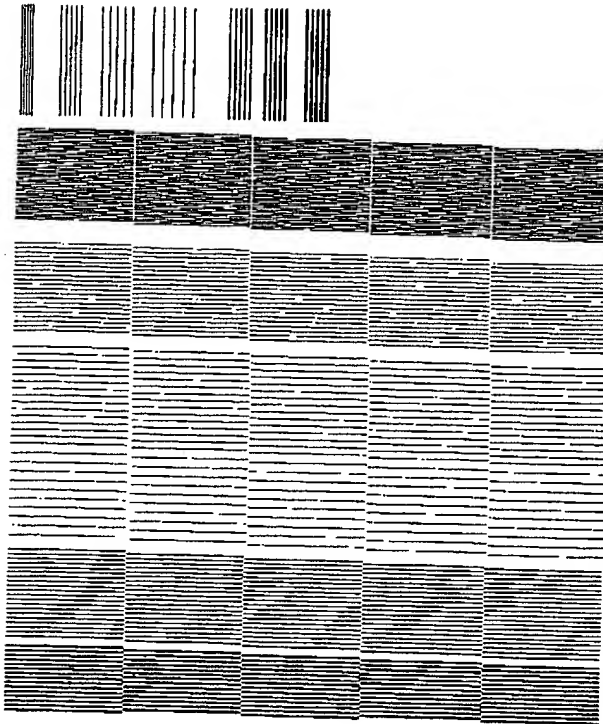
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